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Functionalization of whole-cell bacterial reporters with magnetic nanoparticles

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Abstract

We developed a biocompatible and highly efficient approach for functionalization of bacterial cell wall with magnetic nanoparticles (MNPs). Three Acinetobacter baylyi ADP1 chromosomally based bioreporters, which were genetically engineered to express bioluminescence in response to salicylate, toluene/xylene and alkanes, were functionalized with 18±3nm iron oxide MNPs to acquire magnetic function. The efficiency of MNPs functionalization of Acinetobacter bioreporters was 99.96±0.01%. The MNPs-functionalized bioreporters (MFBs) can be remotely controlled and collected by an external magnetic field. The MFBs were all viable and functional as good as the native cells in terms of sensitivity, specificity and quantitative response. More importantly, we demonstrated that salicylate sensing MFBs can be applied to sediments and garden soils, and semi-quantitatively detect salicylate in those samples by discriminably recovering MFBs with a permanent magnet. The magnetically functionalized cells are especially useful to complex environments in which the indigenous cells, particles and impurities may interfere with direct measurement of bioreporter cells and conventional filtration is not applicable to distinguish and harvest bioreporters. The approach described here provides a powerful tool to remotely control and selectively manipulate MNPs-functionalized cells in water and soils. It would have a potential in the application of environmental microbiology, such as bioremediation enhancement and environment monitoring and assessment. © 2010 The Authors. Journal compilation © 2010 Society for Applied Microbiology and Blackwell Publishing Ltd.

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